

ARMY CONCEPT FOR
SPACE AND LIGHTSAT

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Abstract

This paper explains the Army's role in space both now and in the future, and how space capabilities support joint AirLand Battle doctrine across the full spectrum of conflict. It concludes with a focus on the Army's requirements for the use of lightsats.

Text

Space can enhance the Army's ability to execute AirLand Battle doctrine in joint and combined operations at all levels across the full spectrum of conflict. The Army must leverage off of existing space platforms as well as developmental programs and start now to tailor requirements to fully meet Army needs in the future.

Space enhances operations through all levels of war, strategic to tactical. At the strategic level the Army will work as a full partner with the Air Force and Navy as a service component of the U.S. Space Command. The Army supports strategic defense research with the Strategic Defense Command which is also working tactical missile defense.

Space systems support worldwide communications and information as the Army deploys rapidly to fight in any area of strategic concern, such as Grenada.

At the operational level space supports joint campaigns, characterized by extended distances, (hundreds of kilometers) and long duration, days, even weeks, (as opposed to hours) by providing information such as weather, and command and control to allow the commander to plan for and execute a joint campaign into denied areas.

At the tactical level space can help commanders position forces and support at the critical place to concentrate joint combat power. Good weather information helps to synchronize forces, especially Army aviation operations. Space systems have a global perspective enhancing joint and combined operations by providing the same data for all efforts. For example, weather satellites provide common information to the Army and the Air Force for use across strategic, operational, and tactical levels ensuring decisions and forces are well synchronized.

Not only does space apply across the levels of war, it is also relevant throughout the spectrum of conflict from low to high intensity.

In low intensity conflicts, space systems offer significant political and technical advantages. Space platforms can be employed quickly and without concern for national boundary restrictions. Space systems provide a unique capability to deliver information support to contingency theaters.

This capability of remote processing is available across all spectrums but is especially vital in low intensity conflicts. Remote processing is a good example of how space systems can lighten the force by removing large processing vans from the field, enhancing force deployability and agility.

At the mid and high intensity levels, from contingency to mature theaters, space systems traverse boundaries without problems such as in the Falklands and the recent Gulf conflict. Space systems provide accurate information worldwide to assist the Joint Commander in seizing the initiative and offer long legged communications to facilitate rapid decision making and force sustainability.

Addressing the issue of vulnerability of space systems for mid and low intensity conflicts, space platforms are highly secure since the adversaries don't have the ability to attack them. In fact, attack on a satellite would be considered a strategic act and could initiate high intensity conflict. Even in high intensity conflict, a war where everything is at risk, space systems are less vulnerable than a division CP or an artillery tacfire Headquarters.

Space can enhance the execution of joint AirLand Battle Doctrine in rear, close, and deep operations as a combat multiplier, increasing force effectiveness particularly at the operational and tactical levels.

The deep operation entails disrupting the enemy's tempo and effecting his uncommitted follow on forces. Space can provide weather information at the target for both aircraft and terminally guided electro optical munitions. Space supports operations at depth on the battlefield thru information and communications for deep operations, and provides alternatives which insure vital coverage of the area of operation. Seeing deep is critical and space gives us the necessary redundancy needed for deep operations.

Synchronization of the close operation will be greatly enhanced with the position and navigation capability soon to be available.

This will allow units to locate themselves, boundaries and phase lines, and to navigate quickly in all weather, day and night, and through the fog of war. Weather intelligence will be able to forecast the critical illumination threshold necessary to allow division or corps commanders to plan for and conduct night Army aviation operations.

Space will enhance the rear operation, from the port all the way to the main battle area, by rapidly providing information and by providing terrain management and positioning as well as strategic communications to the sustaining base for combat service support.

We will now examine what's available to support this concept.

Current space capabilities to support the Army include position location/navigation satellites such as the GPS which will be able to tell anyone with a passive receiver where they are, practically worldwide. The Army has some test terminals but no tactical capability.

Communication satellites have been available for some time and offer worldwide communication with virtual line of sight to anyone anywhere on earth. Current satellites include Defense Satellite Communication System (DSCS) satellites, Air Force and Navy COMSATS, and a myriad of commercial satellites. Currently strategic support is green but we have limited tactical use of COMSATS by the Army, except for special operations.

The Army's TENCAP program has been successful providing support to tactical commanders, but there are still unsatisfied needs.

Weather and environmental information is available from satellites such as the two Defense Meteorological Satellite Program satellites (low polar earth orbiters) and by civilian Geosynchronous Operational Environmental Satellites (two of the five covering the world are U.S.). Currently weather data is transmitted through the Air Force Global Weather Central and comes to the Army commander as a fair to partly cloudy forecast.

In considering where the Army should go in the future regarding space capabilities, the Army Space Institute did a desk top analysis to determine direction and pay offs for the near, mid and long term. We used a top down approach based on the latest "Architecture of the Future Methodology". We examined space capability pay offs for each level of command, across the seven battlefield operating systems: maneuver, fires, air defense, mobility and survivability, intelligence, command and control, and combat service support.

The emerging results of this analysis drove us to the following strategy:

- For a now capability, Army efforts need to leverage off existing capabilities and we could do this with ground terminals and receivers.

- For the mid term the Army should leverage off satellites in advanced development but concentrate on better data processing to support Army requirements.

- For the far term the Army should start now to influence and accelerate research and development and examine non developmental items to influence future satellite design and operation.

In the near term, continued and increased production of POS NAV receivers would give the Army limited unit location capability and would substantially improve aircraft navigation, while capitalizing on a multi billion dollar space program. Similarly continued fielding of satellite receivers for communication and information will take advantage of the systems overhead today. A simple antenna can bring the Army worldwide weather and give the commander what television gives all of us on a daily basis.

In the mid term, hand held GPS receivers could be produced and issued down to platoon level, fully taking advantage of the constellation aloft. Improved ground stations to support extremely high frequency communication satellites and improvements in processing information will give the Army a better picture and these capabilities could be developed to Division and perhaps Brigade level. Processing the weather data would provide commanders the effects of weather on our weapon systems and provide forecasts as well as nowcasts.

In the far term, The Army needs to state its requirements now, tailored to the CINC's needs, as new systems are developed. As the Army looks to the future, it must develop multipurpose systems which integrate command and control of more than one space capability, and it should stress the prospect of lightning the force by remote processing. The Space Institute's analysis of the "Space Architecture of the Future" was inherently evolutionary, leveraging off systems and developments available today and programmed for the future.

The Army must be alert to new technological breakthroughs which will revolutionize the use of space, as well as the way it fights. Recently the physics world has been turned upside down by the prospect of super conductivity at higher temperatures. The possibility of 100% electrical efficiency, and the prospect for resistance free electrical power generation and processors draws nearer each day. The effect of super conductivity on Army developments is not known, but the impact will be significant and the Army needs to be prepared to capitalize on it.

The direction now is to develop plans leveraging current capabilities which support Army needs to enhance AirLand Battle Doctrine. The Army is implementing the architecture by articulating its requirements to transition from current capabilities to far term payoffs in a coordinated way.

Our initiatives are based on a sound concept, which supports current doctrine, guides technology, and highlights payoffs and strategy as the Army transitions from today and develops the architecture of the future for the Army and space.

COMMUNICATIONS LIGHTSIGHT

Purpose. This portion of the document articulates the Army requirements for the communications lightsat. The capability is to be developed as part of the DARPA Advanced Satellite Technology Program (ASTP).

Operational Characteristics.

Space Segment. The space segment will consist of a constellation of small, light-weight, low earth orbiting satellites which provide near continuous communication capability for the theater commander. The satellites will initially operate in the UHF frequency band and as technology advances be capable of operating in the SHF and EHF bands. Each UHF lightsat will initially consist of one transponder with a bandwidth of at least 25 kHz which can be subdivided into 5 kHz channels. An initial comm lightsat system of two satellites will support five digital data nets with a ten minute transmit window eight times per day. Although the number of nets is limited by the size of the satellite transponder, the space segment availability of the initial system will be improved as the number of satellites increases. For example, a constellation of six satellites will provide each of the five nets with a satellite available 24 times per day. The comm lightsat system must be responsive enough to reconstitute the constellation to ensure the commander can maintain this near-continuous capability. The size and weight of the comm lightsats will be such that they can be built in quantity, easily stored and quickly launched. The comm lightsat will have an on orbit life of at least one year during periods of continuous use and at least three years during periods of non-continuous use.

Control Segment. The comm lightsat spacecraft and payload will require only minimum essential control functions such as temperature control and power gain to permit the use of desk top size personal computers for monitor and control. These small control terminals will be located in DOD Satellite Control System ground stations, and in secondary theater command and control facilities.

Ground Segment. The ground segment will consist of existing and planned militarized manpack and vehicle SATCOM terminals such as the PSC-3, VSC-7, Advanced Manpack UHF Terminal (AMUT), WSC-3, MSC-64, GSC-40 and URC-100/101.

Operational Plan. Comm lightsats will provide the theater commander with satellite communications which he can allocate to support his concept of operations. The comm lightsat system will augment current and planned communications systems by providing the Theater Commander an additional capability which is not dependent upon terrestrial relays, or ordinarily limited by terrain masking, or preempted by higher priority strategic users. Comm lightsats will be capable of supporting rear, close, and deep operations which can utilize secure burst data communications for admin/log reports, intelligence reports, and targeting data. The system will provide a "bent pipe" capability for users within the satellite footprint (1700 NM/3000 KM diameter circle) in which message transfer will be instantaneous. Recipients outside of the footprint will experience delays in message transfer dependent upon the number of satellites and their location. In this case the satellite will store the messages and transmit them to the recipients when it comes in view. Although the initial constellation of two satellites will have delays of up to five hours, these delays will decrease to less than 30 mins as the number of satellites increases to six and crosslinks between satellites are implemented.

Organizational Plan. USSPACECOM will operate the fixed station control segments. Selected organizations within the supported theater will operate satellite control stations in order to enhance survivability of the lightsat command and control system. Spacecraft and payload control will be conducted in accordance with current DOD control procedures. The complexities involving this control will be transparent to the supported Theater Commander. Launchers which facilitate ease of launch, reload, and enhance survivability will be used to place the space segment into orbit from CONUS. Army units worldwide will operate the ground receivers.

System Constraints.

Space Segment. The space segment will be lighter weight and less expensive than traditional satellites to enable ease of launch and affordable capability. Comm lightsats will weigh hundreds of pounds as compared to thousands of pounds for current satellites. Lightsats will cost millions of dollars as compared to hundreds of millions for current satellites.

The comm lightsat system will be responsive enough to provide near-continuous coverage over a particular theater. The initial system will support five digital data nets with a ten minute transmit window eight times per day. The frequency of support will increase to 24 times per days as the constellation grows to six.

Initial spacecraft transponders will have sufficient transmit power to ensure messages can be received by current UHF antennas. The 5 kHz channels will be capable of supporting the data rates of current and planned UHF receivers (at least 300 bits/sec). Lightsat will have the maximum data storage capacity possible to store text messages received from tactical users (approximately five megabytes).

Control Segment.

Lightsat control segments will be interoperable with current DOD satellite control systems. For example, comm lightsats will be able to be controlled from fixed facilities such as the Consolidated Space Operations Center (CSOC) as well as from mobile facilities in the field.

The control segment will only have minimum essential control functions on board spacecraft to reduce weight and complexity.

Ground Segment.

The ground segment will utilize existing and planned Army SATCOM terminals such as the AN/PSC-3, VSC-7, AMUT, WSC-3, MSC-64, GSC-40, and URC-100/101.

Manprint.

Manpower and Personnel. There will not be any increase in maintenance or operator personnel. There will not be any need for new MOS.

Training. Training similar to currently fielded SATCOM terminals will be utilized.

System Safety and Health Hazard. The comm lightsat will comply with applicable safety and health design requirements and present no uncontrolled safety or health hazards to personnel through its life cycle.

The Army Space Institute has other lightsat requirements. They are classified and available from the Institute with appropriate credentials.

Army Space Institute's point of contact for lightsat is LTC Ron Forkenbrock, Chief of Concepts and Studies. Phone number 913-684-3760/3346 or AV 552-3760/3347. Mailing address: Commandant
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